February 15, 2011 Lecturer Dmitri Zaitsev Hilary Term 2011

Course 2E02 2011 (SF Engineers & MSISS & MEMS)

S h e e t 4

Due: at the end of the tutorial

Exercise 1

Find the coordinates of the vector $\mathbf{v}$ with respect to the basis $\mathbf{v}_1, \ldots, \mathbf{v}_n$ (i.e. the coefficients $k_1, \ldots, k_n$ in the representation $\mathbf{v} = k_1\mathbf{v}_1 + \cdots + k_n\mathbf{v}_n$:

(i) $\mathbf{v} = (1, 3)$, $\mathbf{v}_1 = (1, -1)$, $\mathbf{v}_2 = (-1, 2)$;

(ii) $\mathbf{v} = (2, -1, -1)$, $\mathbf{v}_1 = (1, 1, 0)$, $\mathbf{v}_2 = (1, 0, -1)$, $\mathbf{v}_3 = (0, 1, 1)$;

(iii) $\mathbf{v} = (1, -1, -2, 2)$, $\mathbf{v}_1 = (1, 0, 0, 0)$, $\mathbf{v}_2 = (1, 1, 0, 0)$, $\mathbf{v}_3 = (0, 0, 1, 0)$, $\mathbf{v}_4 = (1, 0, 0, 1)$.

Exercise 2

Find bases and dimensions for the row, column and null spaces of the matrix:

(i) $\begin{pmatrix} 1 & 4 & 0 \\ 1 & -2 & 1 \end{pmatrix}$;

(ii) $\begin{pmatrix} 1 & -2 \\ -1 & 2 \\ 4 & -8 \end{pmatrix}$;

Exercise 3

Find the subset of the vectors that forms a basis of their span:

(i) $\mathbf{u}_1 = (1, -1, 1)$, $\mathbf{u}_2 = (-2, 2, -2)$.

(ii) $\mathbf{u}_1 = (2, 1, 1)$, $\mathbf{u}_2 = (1, 1, 1)$, $\mathbf{u}_3 = (0, -1, -1)$.